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10/523,463

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Jurgen Pawlik

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EXAMINER

HAN, KWANG S

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|--------------------------------------|--|
| Office Action Summary | Application No. 10/523,463 | Applicant(s) PAWLIK ET AL. | |
| | Examiner Kwang Han | Art Unit 1795 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 August 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-47 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 4-47 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

MEMBRANE ELECTRODE UNIT COMPRISING A POLYIMIDE LAYER

Examiner: K. Han SN: 10/523,463 Art Unit: 1795 December 11, 2009

Detailed Action

1. The Applicant's amendment filed on August 31, 2009 was received. Claim 3 was cancelled. Claim 1 was amended. Claims 26-47 were added.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Specification

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 112

4. The claim rejections under 35 U.S.C. 112, second paragraph, on claims 3 and 13 are withdrawn, in view of Applicant's cancellation of claim 3 and amendment of claim 13.

Claim Rejections - 35 USC § 102

5. Claims 1-3, 9, 10, 12, 14, 15, 24, and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Pineri (WO 2002/046278 using US 2004/0058216 for translation and citation) is maintained.

Regarding claims 1, 15, and 24, Pineri discloses an ion conducting membrane for a fuel cell comprising polyimide layers on the two surfaces (1, 3) of the membrane forming a frame structure conferring mechanical properties on the assembly (Figure 1), surrounding the inner portions [0024] and in contact with the electrode [Abstract, 0006, 0007]. An ion conducting membrane with electrodes used for a fuel cell forms a membrane electrode assembly.

Regarding claim 2, Pineri discloses the thickness of the polyimide layer to be between 1 to 10 microns [0053].

Regarding claims 9 and 10, Pineri discloses the material of the proton conducting membrane to be doped with phosphoric acid [0050, 0052].

Regarding claims 12 and 25, the teachings of Pineri as discussed above are herein incorporated. It is noted that claims 12 and 25 are product-by-process claims. "Even though product-by-process are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The membrane electrode assembly of Pineri is similar to that of the Applicant's; Applicant's method of forming a membrane is not given patentable weight in the claims.

Regarding claim 14, Materials used for electrodes inherently have some degree of compressibility.

Claim Rejections - 35 USC § 103

6. Claims 4, 5, 7, 17-19, 26, 29, 30, 34, 35, 39, 44, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri as applied to claims 1 and 15 above and further in view of Cavalca et al. (US 6300000).

Regarding claims 4, 17, 18, 27, 29-30, and 32, the teachings of Pineri as discussed above are herein incorporated. Pineri is silent towards the electrode having an electrochemically active area whose size is at least 2 cm².

Cavalca teaches a fuel cell electrode assembly with examples having a 25 cm² active areas with a performance output values showing milliamps per unit area (Column 22, Lines 30-63). It is well known and obvious to one of ordinary skill in the art to vary the size of the active area of the electrode for a fuel cell dependant on the power requirements for the system.

Regarding claims 5, 7, 19, 35, and 39, Pineri is silent towards at least one of the polyimide layers being coated with fluoropolymers.

Cavalca teaches the use of a hydrophobic component such as a fluoropolymer including FEP (tetrafluoroethylene/hexafluoropropylene copolymer) concentrated at the electrode-membrane interface for the benefit of improving water repellency in the electrode structure (13:18-26). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a coating or layer of a fluoropolymer because Cavalca teaches it provides for improving water repellency in the electrode structure.

Regarding claim 26, Pineri discloses the thickness of the polyimide layer to be between 1 to 10 microns [0053].

Regarding claims 29 and 30, Pineri discloses the material of the proton conducting membrane to be doped with phosphoric acid [0050, 0052].

Regarding claim 32, the teachings of Pineri as discussed above are herein incorporated. It is noted that claim 32 is a product-by-process claim. "Even though product-by-process are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The membrane electrode assembly of Pineri is similar to that of the Applicant's, Applicant's method of forming a membrane is not given patentable weight in the claims.

Regarding claim 34, Materials used for electrodes inherently have some degree of compressibility.

Regarding claim 44, Pineri discloses the ion conducting membrane to be part of a fuel cell membrane electrode assembly [Abstract].

Regarding claim 45, Pineri discloses the ion conducting membrane for a fuel cell comprising polyimide layers on the two surfaces (1, 3) of the membrane and in contact with the electrode overlapping with the electrode [Abstract, 0006, 0007].

7. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri in view of Cavalca et al. as applied to claim 5 above and further in view of D'Agostino et al. (US 4012303) is maintained.

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Regarding claim 6, the teachings of Pineri and Cavalca as discussed above are herein incorporated. Pineri and Cavalca are silent as to the thickness of the fluoropolymer layer.

D'Agostino teaches a fluoropolymer film layer (FEP) useful as a membrane for fuel cells [Abstract] having film thicknesses up to 10 mils (254 microns) to provide mechanical strength and resistance to back pressure (3:58 - 4:8). It would have been obvious to one of ordinary skill in the art at the time of the invention to have a fluoropolymer film layer to have a thickness up to 10 mils thick because D'Agostino teaches it provides mechanical strength and resistance to back pressure when used in a fuel cell assembly.

8. Claims 8, 11, 13 rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri as applied to claims 1 and 10 above and further in view of Savinell et al. (US 5525436) is maintained.

Regarding claim 8, the teachings of Pineri as discussed above are herein incorporated. Pineri teaches the electrolyte membrane to be comprised of sulphonated polyimides but is silent towards the membrane comprising polyazoles.

Savinell teaches solid polymer electrolytes to be comprised of various polymers containing basic groups that can form complexes with stable acids or polymers containing acidic groups such as polyimidazoles, polybenzoxazoles, etc. to form solid polymer electrolytes which are stable and retain sufficient ionic conductivity at high temperatures (2:51-67). It would have been obvious to one of ordinary skill in the art at

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the time of the invention to have the electrolyte membrane to include polyazoles because Savinell teaches these polymers can form complexes with stable acids or polymers containing acidic groups to form a membrane which are stable and retain sufficient ionic conductivity at high temperatures.

Regarding claims 11 and 13, Pineri discloses a membrane doped with phosphoric acid but is silent towards the concentration of the phosphoric acid.

Savinell teaches a proton conducting membrane for a fuel cell that is doped with phosphoric acid to about 50 wt% [Abstract] (10:8-22) for forming a polymer electrolyte membrane capable of conducting protons in temperatures excess of 100°C. It would have been obvious to one of ordinary skill in the art at the time of the invention to use a membrane doped with phosphoric acid to 50 wt% because Savinell teaches this produces a polymer electrolyte membrane capable of conducting protons in temperatures excess of 100°C.

9. Claim 16-18, 20, 21, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri as applied to claims 1 and 19 above and further in view of Bonk et al. (US 6399234) is maintained.

Regarding claims 16-18 and 23, the teachings of Pineri as discussed above are herein incorporated.

Bonk teaches a typical fuel cell assembly where the electrodes (32, 34) and the thermoplastic material completely cover the membrane (48) (Figures 1, 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to have

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the electrode completely cover the membrane because Bonk teaches this structure is typical for a fuel cell assembly.

Regarding claims 20 and 21, the teachings of Pineri as discussed above are herein incorporated. Pineri discloses the two polyimide layers but is silent towards the layers extending beyond the membrane.

Bonk teaches a PEM fuel cell which employs thermoplastic film layers which are extended to the edge of the fuel cell components such as the proton exchange membrane which is bonded and sealed to reduce the likelihood of introducing contaminants to the membrane (8:47-57; Figure 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a polyimide layer to be extended beyond the membrane and to be bonded because Bonk teaches this type of film layer structure for a fuel cell seals and reduces the likelihood of introducing contaminants to the membrane.

10. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri as applied to claim 1 above, and further in view of Bonk et al. and Okamoto et al. (JP 2001-196082, machine translation) is maintained.

Regarding claim 22, Pineri discloses the polyimide layer to be on the opposing sides of the membrane but is silent towards the polyimide layers to be in contact with the separator plates.

Bonk teaches a PEM fuel cell which employs thermoplastic film layers which are extended to the edge of the fuel cell components such as the proton exchange

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membrane which are bonded and sealed to reduce the likelihood of introducing contaminants to the membrane (8:47-57; Figure 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a polyimide layer to be extended beyond the membrane and to be bonded because Bonk teaches this type of film layer structure for a fuel cell seals and reduces the likelihood of introducing contaminants to the membrane.

Okamoto teaches an electrode unit structure for a fuel cell which provides a polyimide seal in contact with the electrode, membrane, and the separators at the peripheral regions to provide a seal to prevent the loss of moisture and acid [0012] (Drawing 1). It would have been obvious to one of ordinary skill in the art to combine the teachings of Bonk and Okamoto to form a polyimide layer further extended as a seal in Pineri's membrane structure because Okamoto teaches that a polyimide seal prevents the loss of moisture and acid within the fuel cell structure.

11. Claims 28, 31, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri and Cavalca et al. as applied to claims 5 above, and further in view of Savinell et al.

Regarding claim 28, the teachings of Pineri as discussed above are herein incorporated. Pineri teaches the electrolyte membrane to be comprised of sulphonated polyimides but is silent towards the membrane comprising polyazoles.

Savinell teaches solid polymer electrolytes to be comprised of various polymers containing basic groups that can form complexes with stable acids or polymers

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containing acidic groups such as polyimidazoles, polybenzoxazoles, etc. to form solid polymer electrolytes which are stable and retain sufficient ionic conductivity at high temperatures (2:51-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to have the electrolyte membrane to include polyazoles because Savinell teaches these polymers can form complexes with stable acids or polymers containing acidic groups to form a membrane which are stable and retain sufficient ionic conductivity at high temperatures.

Regarding claim 31, Pineri discloses a membrane doped with phosphoric acid but is silent towards the concentration of the phosphoric acid.

Savinell teaches a proton conducting membrane for a fuel cell that is doped with phosphoric acid to about 50 wt% [Abstract] (10:8-22) for forming a polymer electrolyte membrane capable of conducting protons in temperatures excess of 100°C. It would have been obvious to one of ordinary skill in the art at the time of the invention to use a membrane doped with phosphoric acid to 50 wt% because Savinell teaches this produces a polymer electrolyte membrane capable of conducting protons in temperatures excess of 100°C.

Regarding claim 33, Pineri discloses a membrane doped with phosphoric acid but is silent towards the concentration of the phosphoric acid.

Savinell teaches a proton conducting membrane for a fuel cell that is doped with phosphoric acid to about 50 wt% [Abstract] (10:8-22) for forming a polymer electrolyte membrane capable of conducting protons in temperatures excess of 100°C. It would have been obvious to one of ordinary skill in the art at the time of the invention to use a

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membrane doped with phosphoric acid to 50 wt% because Savinell teaches this produces a polymer electrolyte membrane capable of conducting protons in temperatures excess of 100°C.

12. Claims 36-38, 40-41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri and Cavalca et al. as applied to claim 35 above, and further in view of Bonk et al.

Regarding claims 36-38 and 43, the teachings of Pineri as discussed above are herein incorporated.

Bonk teaches a typical fuel cell assembly where the electrodes (32, 34) and the thermoplastic material completely cover the membrane (48) (Figures 1, 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to have the electrode completely cover the membrane because Bonk teaches this structure is typical for a fuel cell assembly.

Regarding claims 40 and 41, the teachings of Pineri as discussed above are herein incorporated. Pineri discloses the two polyimide layers but is silent towards the layers extending beyond the membrane.

Bonk teaches a PEM fuel cell which employs thermoplastic film layers which are extended to the edge of the fuel cell components such as the proton exchange membrane which is bonded and sealed to reduce the likelihood of introducing contaminants to the membrane (8:47-57; Figure 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a polyimide layer to be

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extended beyond the membrane and to be bonded because Bonk teaches this type of film layer structure for a fuel cell seals and reduces the likelihood of introducing contaminants to the membrane.

13. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri and Cavalca et al. applied to claim 5 above, and further in view of Bonk et al. and Okamoto et al. (JP 2001-196082, machine translation).

Regarding claim 42, Pineri discloses the polyimide layer to be on the opposing sides of the membrane but is silent towards the polyimide layers to be in contact with the separator plates.

Bonk teaches a PEM fuel cell which employs thermoplastic film layers which are extended to the edge of the fuel cell components such as the proton exchange membrane which are bonded and sealed to reduce the likelihood of introducing contaminants to the membrane (8:47-57; Figure 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a polyimide layer to be extended beyond the membrane and to be bonded because Bonk teaches this type of film layer structure for a fuel cell seals and reduces the likelihood of introducing contaminants to the membrane.

Okamoto teaches an electrode unit structure for a fuel cell which provides a polyimide seal in contact with the electrode, membrane, and the separators at the peripheral regions to provide a seal to prevent the loss of moisture and acid [0012] (Drawing 1). It would have been obvious to one of ordinary skill in the art to combine

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the teachings of Bonk and Okamoto to form a polyimide layer further extended as a seal in Pineri's membrane structure because Okamoto teaches that a polyimide seal prevents the loss of moisture and acid within the fuel cell structure.

14. Claims 46 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pineri and Cavalca et al. as applied to claim 5 above, and further in view of Steck et al. (US 5464700).

The teachings of Pineri and Cavalca as discussed above are herein incorporated.

Regarding claims 46 and 47, Pineri and Cavalca are silent towards the overlap of the frame or the frame not covering the free electrode area.

Steck teaches that a gasketed membrane electrode assembly can employ gasketing material at the periphery for a specific percentage (6:64-7:34) of the ion exchange membrane rather than the membrane itself as a gasket because it provides a seal between the separator plates that is more effective and economical than assemblies employing the membrane itself [Abstract]. It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a gasketing material at the periphery of the ion exchange membrane to act as a frame because Steck teaches this provides a seal between the separator plates that are more effective and economical than assemblies employing the membrane itself. It has been held that prior art which teaches a range overlapping or touching the claimed range anticipates if the prior art range discloses the claimed range with "sufficient specificity" (MPEP 2131.03).

Response to Arguments

15. Applicant's arguments filed August 31, 2009 have been fully considered but they are not persuasive.

Applicant's principal arguments are:

(a) The frame limitation is the portion of the polyimide layer which extends beyond the membrane and electrode defined by the drawing as shown in the Applicant's Remarks and Pineri does not disclose a frame structure.

In response to Applicant's arguments, please consider the following comments:

(a) The limitations of amended claim 1 simply recite a "frame structure" and does not positively recite the frame being a portion of the polyimide layer which extends beyond the membrane. Furthermore Applicant's drawing provided in the Remarks is not part of the original disclosure for the Application. The drawing is new matter and cannot be used to further define the use of the term "frame structure". The rejection presented above meets the broadest reasonable interpretation of the claimed limitations.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact/Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang Han whose telephone number is (571) 270-5264. The examiner can normally be reached on Monday through Friday 8:00am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on (571) 272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/K. H./

Examiner, Art Unit 1795

/Dah-Wei D. Yuan/

Supervisory Patent Examiner, Art Unit 1795